

## **REMARKS**

By the present amendment, claims 1 and 2 are under consideration in the application. Claim 6 has been withdrawn due to the restriction requirement.

### **Amendments To The Claims**

The amendment adding the phrase “having ferritic structure” to claims 1 and 2 is based on the description “promotes ferrite formation by suppressing the formation of detrimental carbides, is important for improving elongation and can satisfy both strength and ductility” (specification, page 5, lines 6 - 9), “suppresses the formation of detrimental carbides and promotes the ferrite formation” (specification, page 5, lines 31 - 33), and “This is important to increase the occupying ratio ferrite by precipitating it and to improve ductility” (specification, page 10, lines 19 - 20).

As discussed in the specification, present invention secures the high strength, hole expandability and ductility by strengthening ferrite structure by precipitation of Ti and/or Nb carbides and therefore having ferrite structure is important.

### **§103**

Claims 1 to 3 and 5 were rejected under 35 U.S.C. §103(a) as being unpatentable over Japan No. 2001-342543 or U.S. Patent No. 6,364,968 to Yasuhara et al. alone or in view of U.S. Patent No. 5,470,529 to Nomura et al.

These rejections, as applied to the amended claims, are respectfully traversed.

### **The Present Invention**

The present invention provides as claimed in the amended claim 1, a high-strength hot-rolled steel sheet having ferritic structure excellent in hole expandability and ductility, consisting of, in terms of mass %.

C: 0.01 to 0.09%, Si: 1.2 to 1.5%, Mn: 0.5 to 3.2%, Al: 0.003 to 1.5%  
P: 0.03% or below, S: 0.005% or below, Ti: 0.10 to 0.25%, Nb: 0.01 to 0.05%, and the  
balance consisting of iron and unavoidable impurities, and satisfying all of the following  
formulas <1> to <3>:

$$\begin{array}{lll} 0.9 \leq 48/12 \times C/Ti < 1.7 & \dots & <1> \\ 50, 227 \times C - 4479 \times Mn > - 9860 & \dots & <2> \\ 811 \times C + 135 \times Mn + 602 \times Ti + 794 \times Nb > 465 & \dots & <3>, \text{ and} \end{array}$$

having strength of at least 980 N/mm<sup>2</sup>, and as claimed in the amended claim 2, a high-  
strength hot-rolled steel sheet having ferritic structure excellent in hole expandability and  
ductility, consisting of, in terms of mass %:

C: 0.01 to 0.09%, Si: 1.2 to 1.5%, Mn: 0.5 to 3.2%, Al: 0.003 to 1.5%, P:  
0.03% or below, S: 0.005% or below, Ti: 0.10 to 0.25%, Nb: 0.01 to 0.05%, and at least  
one of Mo: 0.05 to 0.40% and V: 0.001 to 0.10%, and the balance consisting of iron and  
unavoidable impurities, and satisfying all of the following formulas <1>' to <3>':

$$\begin{array}{lll} 0.9 \leq 48/12 \times C/Ti < 1.7 & \dots & <1>' \\ 50, 227 \times C - 4479 \times (Mn + 0.57 \times Mo + 1.08 \times V) > - 9860 & & \\ & \dots & <2>' \\ 811 \times C + 135 \times (Mn + 0.57 \times Mo + 1.08 \times V) + 602 \times Ti + 794 \times Nb > 465 & & \\ & \dots & <3>', \end{array}$$

and having strength of at least 980 N/mm<sup>2</sup>.

### **The Present Invention**

In order to provide a high-strength hot-rolled a steel sheet with hole  
expandability and ductility having a strength of at least 980 N/mm<sup>2</sup>, the present inventors  
discovered the following technical concepts; 1) sufficiently forming a ferrite structure to

enhance ductility, 2) suppressing generation of hard structures such as martensite structure and bainite structures to enhance hole expandability, 3) strengthening without adding Mg.

In order to realize the above concept, the present invention controls the contents of the components of the steel so that the contents satisfy the formulas <1> to <3> and strengthens ferrite structure by Ti and/or Nb carbide precipitation.

In particular, both ductility and hole expandability are improved by controlling the content of C, which increases strength by carbide precipitation while deteriorating hole expandability, and the content of Mn, which increases strength while deteriorating elongation, through formula <3>.

It is a remarkable effect of the present invention that a steel excellent in both ductility and hole expandability can be obtained by strengthening ferrite structure by controlling contents of the components of the steel through formula <3> without adding Mg.

As shown in attached reference Figure, in the past, precipitation strengthening type steel sheets have been low in hole expandability, and bainite type steel sheets have been low in ductility.

There has not been in the prior art a precipitation strengthening type steel sheet having high hole expandability without Mg as in the present invention.

### **Patentability**

#### **Japan No. 2001-342543 (“JP ‘543”)**

The steel sheet disclosed in JP ‘543 secures strength of the 590 to 780 N/mm<sup>2</sup> class, hole expandability and ductility by a mandatory adding of Mg to the steel.

The steel of JP ‘543 has bainite in the structure and secures strength by the bainite structure.

The steel of JP '543 contains 0.0005% or more of Mg which has the function to make the size of Ti and/or Nb carbides small [paragraph 0025], and thereby improving hole expandability and ductility [paragraph 0023].

Therefore, if no Mg is added in JP '543, the steel sheet disclosed in JP '543 cannot secure the effect of making the size of Ti and/or Nb carbides small and improve hole expandability and ductility.

Further, although Example steel V of JP '543 satisfies formulas <1> and <2>, this Example V steel does contain a large amount of Mg of 0.003%, and does not satisfy formula <3>.

Formula <3> is essential for the present invention which does not contain Mg to secure hole expandability and ductility.

JP '543 does not disclose or suggest a steel sheet of the present invention which is a high-strength hot-rolled steel sheet having ferritic structure, excellent in hole expandability, ductility, having a strength of at least 980 N.mm<sup>2</sup> and without containing Mg.

**U.S. Patent No. 4,364,968 ("US '968")**

The steel sheet disclosed in US '968 has a bainite structure as a micro-structure. (US '968, Col. 3, lines 51 - 52; Col. 8, lines 24 - 27.

The steel sheet of US '968 improves strength and hole expandability by a bainite structure (see, e.g., steel 7: Table 3) and is different from the present invention wherein strength and hole expandability is improved by precipitation strengthening of a ferrite structure.

Further, the Examples of US '968 all show the Si content of less than 1.0 wt% and therefore US '968 clearly denies an Si addition of more than 1.0%.

Thus, US '968 does not disclose or suggest the improvement of ductility and hole expandability by strengthening ferrite structure and further by satisfying formula <3> of the present invention.

**US Patent No. 5,470,529 ("US '529")**

The secondary reference, US '529, does not cure the defects in the disclosure of JP '543 and/or US '968.

It is therefore submitted that amended independent claims 1 and 2 are patentable over JP '543 and/or US '968 in view of US '529.

**CONCLUSION**

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

KENYON & KENYON LLP

By: John J. Kelly, Jr.  
John J. Kelly, Jr.  
Reg. No. 29,182

Dated: June 9, 2009

KENYON & KENYON LLP  
One Broadway  
New York, NY 10004  
Telephone No. (212) 425-7200  
Facsimile No. (212) 425-5288  
**CUSTOMER NO. 26646**

Reference Figure

